失控

机器、社会与经济的新生物学

[美] 凯文·凯利（Kevin Kelly） 著

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OUT OF CONTROL

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[2] [illegible]meme[illegible]

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[1] [illegible]Democritus[illegible]460[illegible]370[illegible]

[2] [illegible]Xenophon[illegible]434[illegible]355[illegible]

[3] [illegible]Aristotle[illegible]384[illegible]322[illegible]

[4] [illegible]·[illegible]Rudolf Steiner, 1861.02.27[illegible]1925.03.30[illegible]anthroposophy[illegible]

[5] [illegible]Nine Lectures on Bees

[6] [illegible]·[illegible]Maurice Maeterlinck, 1862[illegible]1949[illegible]1911[illegible]

[7] [illegible]·[illegible]·[illegible]William Morton Wheeler, 1865[illegible]1937[illegible]

[8] [illegible]·[illegible]Loren Carpenter, 1947[illegible]

[9] [illegible]·[illegible]James Gleick, 1954.08.01[illegible]

[10] [illegible]·[illegible]Craig Reynolds, 1953.03.15[illegible]1986[illegible]“[illegible]”[illegible]

[11] [illegible]·[illegible]Lloyd Morgan, 1852.02.06[illegible]1936.03.06[illegible]

[12] [illegible]·[illegible]

[13] [illegible]West Riding Lunatic Asylum

[14] [illegible]Monty Python's Flying Circus[illegible]1969[illegible]BBC[illegible]

[15] [illegible]·[illegible]John Hughlings Jackson, 1835.03.04[illegible]1911.10.07[illegible]

[16] [illegible]The Invention of Memory

[17] [illegible]Celestial Emporium of Benevolent Knowledge

[18] [illegible]·[illegible]Wilder Graves Penfield, 1891.01.26[illegible]1976.04.05[illegible]

[19] [illegible]·[illegible]Douglas Richard Hofstadter, 1945.02.15[illegible]1980[illegible]

[20] [illegible]·[illegible]David Courtnay Marr, 1945.01.19[illegible]1980.11.17[illegible]

[21] [illegible]·[illegible]Pentti Kanerva[illegible]“[illegible]”[illegible]

[22] [illegible]Sparse Distributed Memory

[23] [illegible]Palo Alto[illegible]

[24] [illegible]Digital Equipment Corporation

[25] [illegible]·[illegible]Norbert Wiener, 1894.11.26[illegible]1964.03.08[illegible]

[26] [illegible]·[illegible]Chris Langton, 1949[illegible] [illegible]1980[illegible]1987[illegible]“[illegible]”[illegible]

[27] [illegible]Frank Hwang[illegible]1967[illegible]29[illegible]1996[illegible]

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[29] [illegible]·[illegible]Dietrich Braess[illegible]

[30] [illegible]·[illegible]Alan Kay, 1940.05.17[illegible] [illegible]

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[illegible]“[illegible]”[illegible]·[illegible][17][illegible]1874[illegible]“……[illegible]……”

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3.4 [illegible]

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[illegible]“[illegible]……[illegible]”

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]——[illegible]‘[illegible]’[illegible]”

3.5 [illegible]

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[illegible]“[illegible]”[illegible]·[illegible]·[illegible][22][illegible]“[illegible]”

3.6 [illegible]

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[illegible]——[illegible]——[illegible]1968[illegible]

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[illegible]“[illegible]”[illegible]

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3.7 [illegible][23]

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[illegible][24][illegible]

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[illegible]·[illegible][25][illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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[illegible]“[illegible]”

[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]

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[illegible]1984[illegible][26][illegible]

2034[illegible]6[illegible]1[illegible]

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[illegible]·[illegible]

[1] Mark Pauline 1978 “ ”

[2] Vandals “ ”

[3] controlled anarchy

[4] tele-presence

[5] Obtainium KK “ ” Unobtainium Unobtainium “ ”

[6]

[7] Marvin Minsky, 1927 1969

[8] Douglas C. Engelbart, 1925.01.30

[9] [illegible]Robbie the Robot[illegible]1956[illegible]Forbidden Planet[illegible]

[10] [illegible]Field Robotics[illegible]

[11] [illegible]·[illegible]Rodney A.Brooks[illegible]

[12] [illegible]Fast, Cheap and Out of Control: A Robot Invasion of the Solar System, Journal of The British Interplanetary Society, Vol. 42, pp 478-485, 1989.

[13] [illegible]Jet Propulsion Laboratory

[14] [illegible]Mars Environment Survey

[15] [illegible]Subsumption Architecture

[16] [illegible]·[illegible]Daniel Dennett, 1942[illegible]1971[illegible]Tufts[illegible]

[17] [illegible]·[illegible]William James, 1842[illegible]1910[illegible]

[18] [illegible]The Society of Mind[illegible]·[illegible]1988[illegible]“[illegible]”[illegible]agent[illegible]

[19] [illegible]

[20] [illegible]·[illegible]Brian Yamauchi[illegible]

[21] [illegible]·[illegible]Keith Hensen, 1942[illegible]

[22] [illegible]·[illegible]·[illegible]Heinz von Foerster, 1911.11.13[illegible]2002.10.02[illegible]·[illegible]·[illegible]·[illegible]·[illegible]·[illegible]

[23] [illegible]black patch psychosis

[24] [illegible]Donald Olding Hebb, 1904.07.22[illegible]1985.08.20[illegible]——[illegible]——[illegible]

[25] [illegible]·[illegible]Jack Vernon[illegible]1966[illegible]

[26] [illegible]IEEE Spectrum

04

OUT OF CONTROL

4.1 [illegible]——[illegible]

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[illegible]·[illegible][3][illegible]1934[illegible]

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[illegible]·[illegible]1920[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”

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4.2 [illegible]

1991[illegible]·[illegible]——[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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4.3 [illegible]

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[illegible]·[illegible][7][illegible]——[illegible]——[illegible]

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4.4 [illegible]

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[illegible]·[illegible][10][illegible] 1951 [illegible]

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[illegible]“[illegible]”[illegible]

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[1] [illegible]prairie[illegible]

[2] [illegible]·[illegible]Steve Packard[illegible]·[illegible]

[3] [illegible]·[illegible]Aldo Leopold, 1887[illegible]1948[illegible]“[illegible]”[illegible]

[4] [illegible]

[5] [illegible]savanna[illegible]savanna[illegible]“[illegible]”[illegible]

[6] [illegible]Field of Dreams[illegible]·[illegible]“[illegible]”[illegible]

[7] [illegible]·[illegible]Stuart Pimm[illegible]1971[illegible]1974[illegible]

[8] [illegible]·[illegible]Jim Drake[illegible]

[9] [illegible]·[illegible]Stuart Kauffman, 1939[illegible] [illegible]Santa Fe Institute[illegible]

[10] [illegible]·[illegible]David Wingate, 1935[illegible] [illegible]

[11] [illegible]

[illegible]12[illegible] [illegible]·[illegible]Danny Hillis, 1956.09[illegible] [illegible]“[illegible]”[illegible]Thinking Machine Corporation[illegible]“[illegible]”[illegible]Connection Machine[illegible]

[illegible]13[illegible] [illegible]Humpty Dumpty[illegible]

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OUT OF CONTROL

5.1 [illegible]

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[illegible]·[illegible]cybernetic holism[illegible]1974[illegible]“[illegible]·[illegible]”

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[illegible]“[illegible]”——[illegible]1952[illegible]·[illegible][8][illegible]“‘[illegible]’[illegible]”

1958[illegible][9][illegible]——“[illegible]（coevolution）”[illegible]1859[illegible]“[illegible]……”

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5.5 [illegible]

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1990[illegible]·[illegible][32][illegible]“[illegible]”[illegible]“[illegible]”[illegible][33][illegible]“[illegible]punk eek[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]”

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[illegible]

[illegible]

[1] [illegible]·[illegible]Stewart Brand[illegible]“[illegible]”[illegible]WELL-Whole Earth'Lectronic Link[illegible]The Whole Earth Catalog[illegible]

[2] [illegible]·[illegible]Gregory Bateson, 1904.05.09[illegible]1980.07.04[illegible]

[3] [illegible]fun-house hall[illegible]“[illegible]”[illegible]

[4] [illegible]·[illegible]John Holland, 1929.02.02[illegible]·[illegible]

[5] [illegible]

[6] [illegible]·[illegible]Paul Ehrlich, 1854.03.14[illegible]1915.08.20[illegible]1908[illegible]

[7] [illegible]milkweed[illegible]

[8] [illegible]·[illegible]Ross Ashby, 1903.09.06[illegible]1972.11.15[illegible]

[9] C. J. [illegible]Charles J. Mode[illegible]

[10] P. W. [illegible]P. W. Price[illegible]2002[illegible]

[11] [illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]1975[illegible]8[illegible]20[illegible]“[illegible]”[illegible]1976[illegible]6[illegible]19[illegible]7[illegible]20[illegible]1982[illegible]11[illegible]1975[illegible]9[illegible]9[illegible]“[illegible]”[illegible]1976[illegible]8[illegible]7[illegible]9[illegible]3[illegible]1978[illegible]7[illegible]4[illegible]

[12] [illegible]40[illegible]

[13] [illegible]

[14] [illegible]M. C. Escher, 1898[illegible]1972[illegible]“[illegible]”[illegible]——[illegible]

[15] [illegible]·[illegible]David Layzer[illegible]1970[illegible]

[16] [illegible]·[illegible]Vladimir Vernadsky, 1863[illegible]1945[illegible]1926[illegible]

[17] [illegible]·[illegible]Eduard Suess, 1831.08.20[illegible]1941.08.26[illegible]

[18] [illegible]Mysticism[illegible]“[illegible]”[illegible]myein[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

“ ”

[19] T. H. T. H. Huxley, 1825.05.04 1895.06.29

[20] · Herbert Spencer “ ”

[21] · Alfred Lotka, 1880.03.02 1949.12.05 1924 1933

[22] · Jean Baptiste Lamarck, 1744.08.01 1829.12.18 1809 Philosophie Zoologique

[23] · Jonathan Weiner 1976 1995 1994 1999 2000

[24] Gaia · 1970

[25] · ynn Margulis, 1938 ·

[26] · · John von Neumann, 1903.12 1957.02

[27] · Oskar Morgenstern, 1902.01.24 1977.07.26 · ·

[28] · Merrill Flood, 1912 1935

[29] · Robert Axelrod

[30] · Anatol Rapoport, 1911.05.22 2007.01.20

[31] · Thomas Hobbes, 1588 1697

[32] · Kristian Lindgren

[33] punctuated equilibrium 1972 N. S. J.

[34] · William Poundstone

[35]

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[illegible]

OUT OF CONTROL

6.1 [illegible]

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[illegible]·[illegible][3][illegible]“[illegible]”

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6.2 [illegible]

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“[illegible]”[illegible]·[illegible]“[illegible]”

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[illegible]“[illegible]”[illegible]

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6.3 [illegible][14]

1916[illegible]·[illegible][15][illegible]“[illegible]……[illegible]”[illegible][16][illegible]

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6.4 [illegible]

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[illegible]

[illegible]·[illegible][22][illegible]“[illegible]”

6.5

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[illegible]——[illegible]——[illegible]

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[illegible]——[illegible]——[illegible]——[illegible]

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[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible][24]

“[illegible]”[illegible][25]

6.6 [illegible]

[illegible]4-H[illegible][26][illegible]

[illegible]——[illegible]

[illegible]

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[illegible]·[illegible][27][illegible]“[illegible]”[illegible][28][illegible]“[illegible]”[29][illegible]

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6.7 [illegible]

[illegible][36][illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible][37][illegible]1914[illegible]“[illegible]”[illegible]

[illegible]·[illegible][38][illegible]

[illegible][39][illegible][40][illegible]·[illegible][41][illegible]

[illegible]

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[illegible]

·[42] [43] “

CT

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“ ”

“ ” becomingness

[1]

[2] patch

[3] · Dan Botkin

[4] · Tony Burgess

[5]

[6]

[7] · Robert May

[8] · John Lawton 1969 1999

[9] · Joel Cohen, 1944.02.10

[10] · Ramon Margalef, 1919 2004

1967

[11]

[12]

[illegible]

[13] [illegible]——[illegible]

[14] [illegible]——[illegible]——[illegible]“[illegible]……[illegible]”[illegible]

[15] [illegible]·[illegible]Frederic Clements, 1874[illegible]1945[illegible]

[16] [illegible]

[17] H. A. [illegible]H.A.gleason, 1882[illegible]1975[illegible]

[18] [illegible]·[illegible]William Hamilton, 1936[illegible]2000[illegible]

[19] [illegible]·[illegible]Howard Pattee[illegible]T. J. [illegible]

[20] [illegible]·[illegible]Robert Ricklefs[illegible]2006[illegible]

[21] [illegible]·[illegible]Julian Adams[illegible]Viramune[illegible]

[22] [illegible]·[illegible]David Ackley[illegible]

[23] [illegible]

[24] [illegible]

[25] [illegible]2008[illegible]“[illegible]”

[26] 4-H[illegible]Head[illegible]Heart[illegible]Hands[illegible]Health[illegible]4-H Club[illegible]

[27] [illegible]·[illegible]Erwin Schrödinger[illegible]

[28] [illegible]negentropy[illegible]

[29] [illegible]extropy[illegible]1988[illegible]1[illegible]·[illegible]·[illegible]“[illegible]”[illegible]·[illegible]

[30] [illegible]

[31] [illegible]·[illegible]Ad Fredkin[illegible]“[illegible]”[illegible]

[32] [illegible]·[illegible]Stephen Wolfram, 1959.08.29[illegible] [illegible]Mathematica[illegible]

[33] [illegible]1080[illegible]1028[illegible]

[34] [illegible]2000[illegible]·[illegible]1994[illegible]0[illegible]1[illegible]

[illegible]10120[illegible]1090[illegible]

[35] [illegible]·[illegible]Freeman Dyson, 1923.12.15[illegible]1956[illegible]“[illegible]”[illegible]

[36] [illegible]entéléchie[illegible]·[illegible]

[37] [illegible]·[illegible]Hans Driesch, 1867.10.28[illegible]1941.04.16[illegible]

[38] [illegible]·[illegible]David Channell[illegible]

[39] [illegible]Copernicus, 1473[illegible]1543[illegible]

[40] [illegible]Freud, 1856[illegible]1939[illegible]

[41] [illegible]·[illegible]Bruce Mazlish[illegible]

[42] [illegible]·[illegible]Gretel Ehrlich[illegible]1978[illegible]1984[illegible]The Solace OF Open Spaces[illegible]D.[illegible]

[43] [illegible]Montana Spaces

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[illegible] [illegible]

OUT OF CONTROL

7.1 [illegible]

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[illegible]“[illegible]”[illegible][1][illegible]

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7.2 [illegible]

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[illegible]——[illegible]——[illegible]

[illegible]1929[illegible]8[illegible][11][illegible]

[illegible][12][illegible]

[illegible]——[illegible]——[illegible]

[illegible]

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[illegible]

[illegible]·[illegible][15][illegible]

[illegible]“[illegible]”[illegible]“[illegible]……[illegible]”

[illegible]

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[illegible]——[illegible]——[illegible]

7.3 [illegible][16]

[illegible]

[illegible][17][illegible]1895[illegible]

[illegible][18][illegible]

1948[illegible][19][illegible]1949[illegible]

[illegible][20][illegible][21][illegible][22][illegible]kubernetes[illegible]governor[illegible]

[illegible]1830[illegible][23][illegible][24][illegible]

[illegible][25][illegible]

[illegible]

[illegible]

[illegible]·[illegible][26]
1956[illegible][27][illegible]1948[illegible]——[illegible]

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[illegible]——[illegible]——[illegible]“[illegible]……”[illegible]

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[illegible]“[illegible]”[29][illegible]——[illegible]——[illegible]

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[illegible]·[illegible][30][illegible]
——[illegible]——[illegible]

[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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[illegible]A[illegible]B[illegible]B[illegible]C[illegible]C[illegible]A[illegible]A[illegible]·[illegible]·[illegible]“[illegible]”[31][illegible]·[illegible][32][illegible]“[illegible]”[33][illegible]——[illegible]——[illegible]

7.4 [illegible]

[illegible]——[illegible]——[illegible]

[illegible]·[illegible][34][illegible]·[illegible][35][illegible]“[illegible]”[illegible][36]——[illegible]

[illegible][37][illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]GOTO START[illegible]

[illegible]——[illegible]

[illegible]self[illegible]“[illegible]ego[illegible]”[illegible]“[illegible][38][illegible]ego[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]

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[illegible]1991[illegible]——[illegible]“[illegible]”[illegible]·[illegible][39][illegible]——[illegible]——[illegible]“[illegible]”[illegible]

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[illegible]·[illegible][40][illegible]·[illegible]

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[1] [illegible]1135[illegible]1189[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[2] [illegible]Ktesibios[illegible]

[3] [illegible]King Ptolemy II[illegible]308[illegible]246[illegible]

[4] [illegible]Archimedes[illegible]287[illegible]212[illegible]

[5] [illegible]Heron, 10[illegible]75[illegible]

[6] [illegible]The Pneumatica

[7] [illegible]·[illegible]Cornelis Drebbel[illegible]

[8] [illegible]·[illegible]James Watt, 1736.01.19[illegible]1819.08.19[illegible]

[9] [illegible]Newcomen[illegible]

[10] [illegible]·[illegible]Thomas Mead[illegible]

[11] H. S. [illegible]H. S. Black[illegible]

[12] [illegible]Aberdeen Proving Ground

[13] [illegible]servomechanism[illegible]

[14] [illegible]·[illegible]Leon Farcot[illegible]

[15] [illegible]·[illegible]Bill Powers[illegible]

[16] [illegible]tautology[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[17] [illegible]·[illegible]Leo Wiener[illegible]·[illegible]

[18] [illegible]·[illegible]Bertrand Russell, 1872[illegible]1970[illegible]

[19] [illegible]The Kinsey Report

[20] [illegible]cybernetics[illegible]·[illegible]

[21] [illegible]Plato[illegible]427[illegible]347[illegible]

[22] [illegible]Socrates[illegible]469[illegible]399[illegible]

[23] [illegible]Ampere, 1775[illegible]1836[illegible]

[24] [illegible]Noologcial Science

[25] [illegible]Cybernetics: or the Control and Communication in the Animal and the Machine

[26] [illegible]·[illegible]Pierre de Latil[illegible]

[27] [illegible]Thinking by Machine

[28] [illegible]·[illegible]Frederick Hayek[illegible]

[29] [illegible]calculation argument

[30] [illegible]·[illegible]Eli Whitney, 1765[illegible]1825[illegible]

[31] [illegible]circular causality

[32] [illegible]·[illegible]Warren McCulloch, 1898.11.16[illegible]1969.09.24[illegible]

[33] [illegible]intransitive preference[illegible]A[illegible]B[illegible]R[illegible]B[illegible]C[illegible]R[illegible]A[illegible]C[illegible]R[illegible]“[illegible]”[illegible]A[illegible]B[illegible]B[illegible]C[illegible]A[illegible]C——“[illegible]”[illegible]B[illegible]C[illegible]A[illegible]B[illegible]B[illegible]C[illegible]A[illegible]C[illegible]C[illegible]A[illegible]

[34] [illegible]·[illegible]Brian Goodwin, 1931[illegible]2009[illegible]2009[illegible]

[35] [illegible]·[illegible]Roger Lewin[illegible]

[36] [illegible]Ouroboros[illegible]8[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]

[37] [illegible]C. G. Jung, 1875[illegible]1961[illegible]

[38] [illegible]mandala[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[39] [illegible]·[illegible]George Gilder[illegible]“[illegible]”[illegible]

[40] [illegible]·[illegible]Leonardo daVinci[illegible]

[41] [illegible]

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OUT OF CONTROL

8.1 [illegible]

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8.2 [illegible]

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1989[illegible]10[illegible]17[illegible]58262[illegible]

58262[illegible][2][illegible]NASA[illegible][3][illegible]

[illegible]“[illegible]”[illegible]58262[illegible]

[illegible]“[illegible]”[illegible]

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[illegible]——[illegible]

8.3 [illegible]

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[illegible]95[illegible]

[illegible]“[illegible]”[illegible]

[illegible]NASA[illegible]1977[illegible][6][illegible]NASA[illegible]NASA[illegible]NASA[illegible]

1986[illegible]NASA[illegible][7][illegible]“[illegible]”[illegible][8][illegible]“[illegible]”[illegible]NASA[illegible]

[illegible]NASA[illegible]

[illegible]·[illegible][9][illegible]“[illegible]”[illegible]

[illegible]

[illegible]NASA[illegible]NASA[illegible]“[illegible]”[illegible]

8.4 [illegible]

[illegible]

[illegible]·[illegible]1982[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”

[illegible]1983[illegible]·[illegible]

[illegible]NASA[illegible]——[illegible]

[illegible]——[illegible]——[illegible]

[illegible]·[illegible]

[illegible]——[illegible]SBV[10]——[illegible]·[illegible]

1988[illegible]9[illegible]·[illegible]·[illegible]SBV[illegible]

[illegible]“[illegible]——[illegible]”[illegible]100[illegible]“[illegible]”[illegible]

——SBV[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”

[illegible]SBV[illegible]

[illegible]·[illegible]·[illegible]

[illegible]

[illegible]

[illegible]1.8[illegible]FDA[illegible]·[illegible]——[illegible]——[illegible]

[illegible][11][illegible]

[illegible]·[illegible]1988[illegible]

[illegible]Bio2[illegible]“[illegible]”[illegible]

8.5 [illegible]

[illegible]——[illegible]——[illegible]——[illegible]

[illegible]

[illegible]SBV[illegible]“[illegible]”[illegible]

[illegible]7[illegible]

[illegible]

[illegible][12][illegible]·[illegible]

[illegible]

[illegible]22.6[illegible]

[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]

“[illegible]”[illegible]·[illegible]“[illegible]‘[illegible]’[illegible]”

[illegible]“[illegible]

[illegible]”

[illegible]“[illegible]”[illegible]——[illegible]

“[illegible]”[illegible]·[illegible]“[illegible]”

[illegible]“[illegible]”[illegible]

[illegible]

“[illegible]”[illegible]——[illegible]——[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]5:3[illegible]·[illegible]——[illegible]——[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]·[illegible]1[illegible]30-40[illegible][13][illegible]

[illegible]“[illegible]——[illegible]”[illegible]——[illegible]

[illegible]——[illegible]

[illegible][14][illegible]

[illegible]90×30[illegible]“[illegible]……[illegible]”[15]

8.6 [illegible]

[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]

“[illegible]”[illegible]“[illegible]”[illegible]“[illegible][16][illegible]·[illegible]”[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible][17][illegible]”

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

- [illegible]
- [illegible]
- [illegible]

◆ [illegible]

◆ [illegible]

◆ [illegible]

◆ [illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]——[illegible]

[illegible]

[illegible]

[1] [illegible]Steinhart Aquarium

[2] [illegible]Jet Propulsion Laboratory

[3] [illegible]Advance Life-support Program

[4] [illegible]32.2[illegible]

[5] [illegible]·[illegible]Evgenii Shepelev[illegible]

[6] [illegible]CELSS[illegible]Controlled Ecological Life Support System

[7] [illegible]Breadboard Project

[8] “[illegible]”[illegible]“[illegible]”[illegible]1958[illegible]10[illegible]1963[illegible]5[illegible]

[9] [illegible]·[illegible]Frank Salisbury[illegible]1955[illegible]1966[illegible]

[10] [illegible]SBV-Space Biosphere Ventures[illegible]·[illegible]1996[illegible]

[11] [illegible]1965[illegible]Astro World[illegible]

[12] [illegible]Smithsonian Institution[illegible]·[illegible]1836[illegible]2008[illegible]

[13] [illegible]

[14] [illegible]mangroves[illegible]mangoes[illegible]

[15] [illegible]2005[illegible]

[16] [illegible]synthetic ecology

[17] [illegible]meta-stable state[illegible]

09

[illegible] “[illegible]”[illegible]

OUT OF CONTROL

9.1 [illegible]

“[illegible]”[illegible]·[illegible]1991[illegible]9[illegible]26[illegible]1993[illegible]9[illegible]26[illegible]

[illegible]——[illegible]——[illegible]

[illegible]·[illegible]“[illegible]”[illegible]·[illegible]1992[illegible]7[illegible]

[illegible]

[illegible]

[illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”[1][illegible]——[illegible][2][illegible]“[illegible]”[illegible]“[illegible]”

[illegible]——[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]——[illegible]

[illegible]“[illegible]”

“[illegible]”[illegible]·[illegible][3][illegible]“[illegible]——[illegible]”

9.2 [illegible]

[illegible][4][illegible]

[illegible]

[illegible]

[illegible][5][illegible]

[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

“[illegible]”

“[illegible]”

“[illegible]”

“[illegible]”

“[illegible]”

[illegible]“[illegible]”

“[illegible]”[illegible]“[illegible]”

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

9.3 [illegible]

[illegible]NASA[illegible]NASA[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]3800ppm[6][illegible]350ppm[illegible]2000ppm[illegible]“[illegible]”[illegible]8000ppm[illegible]NASA[illegible]“[illegible]”[illegible]5000ppm[illegible]1000ppm[illegible]

[illegible]PH[illegible]

[illegible]——[illegible]——[illegible]·[illegible]1955[illegible]“[illegible]”[illegible]

[illegible]315ppm[illegible]350ppm[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]1[illegible]2[illegible]3[illegible]350ppm[illegible]0.03[illegible][7][illegible]“[illegible]”[illegible]15[illegible]“[illegible]”[illegible]

[illegible]1992[illegible]4[illegible]1971[illegible]25[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]21[illegible]15[illegible]6[illegible]

[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]——[illegible]”

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]PH[illegible]“[illegible]”[illegible][8][illegible]“[illegible]”[illegible]

“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]

9.4 [illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible][9][illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]SBV[illegible]——[illegible]

[illegible]·[illegible]“[illegible]”[illegible]——[illegible]

[illegible]·[illegible]“NASA[illegible]SBV[illegible]”

[illegible]——[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”

[illegible]

[illegible]NASA[illegible]

[illegible]·[illegible][10][illegible]

[illegible]“[illegible]”[illegible]“[illegible]”——[illegible]……[illegible]……[illegible]——[illegible]……

[illegible]……

[illegible]——[illegible]——[illegible]

[illegible]50[illegible]J[illegible]“J”[illegible]Junior[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

9.5 [illegible]

1991[illegible]SBV[illegible]·[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

[illegible]

[illegible]

[illegible]

[1] [illegible]keystone predators[illegible]

[2] [illegible]ecological niche[illegible]1910[illegible]R·H·[illegible]

[3] [illegible]Smithsonian[illegible]

[4] [illegible]Ossabaw Island pig[illegible]

[5] [illegible]

[6] ppm[illegible]

[7] [illegible]Biomass[illegible]

[8] [illegible]training wheels[illegible]

[9] [illegible]Brazil[illegible]1985[illegible]“[illegible]”[illegible]

[10] [illegible]·[illegible]Dorion Sagan[illegible]·[illegible]·[illegible]1981[illegible]

10

[illegible]

OUT OF CONTROL

10.1 [illegible]

[illegible]1888[illegible]1929[illegible]“……[illegible]……[illegible]”[illegible]1992[illegible]——[illegible]

[illegible]·[illegible][1][illegible][2][illegible]1884[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible][3][illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]110[illegible]“[illegible]”[4][illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]10[illegible]110[illegible]”[illegible]

[illegible][5][illegible]——[illegible]——[illegible]

[illegible]·[illegible][6][illegible]“[illegible][7][illegible]”[illegible]

[illegible][8][illegible]1984[illegible]1992[illegible]1984[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]

10.2 [illegible]

[illegible]1994[illegible]——[illegible]——[illegible]“[illegible]”[illegible]

[illegible][9][illegible][10][illegible]·[illegible][11][illegible]——[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”

[illegible]

[illegible]

[illegible]

[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible][12][illegible]“[illegible]”[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”

“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible][13][illegible]

10.3 [illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“9”[illegible][14][illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]——[illegible]……[illegible]

[illegible]“[illegible]”[illegible]——[illegible]“[illegible]”

[illegible]

[illegible]·[illegible]“[illegible]”

[illegible]

10.4 [illegible]

[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]·[illegible][15][illegible]

[illegible]“[illegible]”[illegible]“[illegible]”（churns）[illegible]“[illegible]”[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]

10.5 [illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]——[illegible]

[illegible]——“[illegible]”——[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible][16][illegible]NASA[illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

1989[illegible]·[illegible][17][illegible]“[illegible]”[illegible]“[illegible]”[illegible]NASA[illegible]“[illegible]

[illegible]……[illegible]”

“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

“[illegible]”[illegible][18][illegible][19][illegible]

[illegible]——[illegible]——[illegible]

“[illegible]”[illegible]“[illegible]”

[illegible]1975[illegible]3M[illegible]50[illegible]“[illegible]”[illegible]3M[illegible]

[illegible]“[illegible]——[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]

[illegible]”

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]

[illegible][20][illegible]“[illegible]”[illegible]

10.6 [illegible]

[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]1991[illegible]“[illegible]”[illegible]

[illegible]

[illegible]91[illegible]50[illegible]33[illegible]20[illegible]“[illegible]‘[illegible]’[illegible]‘[illegible]’”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]——[illegible]

[illegible]

◆ [illegible]

◆ [illegible]

◆ [illegible]——[illegible]

——[illegible]

◆ [illegible]——[illegible]——[illegible]

[illegible]

[illegible]……[illegible]

[illegible]

[illegible]——[illegible]

[illegible]“[illegible]”[illegible]1992[illegible]4[illegible]“[illegible]”[illegible]1992[illegible]6[illegible]“[illegible]”[illegible]“[illegible]”[illegible]1992[illegible]9[illegible]“[illegible]”[illegible]1992[illegible]DNA[illegible]

[illegible]

[illegible]——[illegible]

[illegible]

[illegible]——[illegible]——[illegible][21][illegible]

[illegible]

[1] [illegible]·[illegible]Antonio Gaudi, 1852.06.25[illegible]1926.06.10[illegible]

[2] [illegible]the Sagrada Familia[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[3] [illegible]The Jetsons[illegible]1962[illegible]1963[illegible]2062[illegible]

[4] 110[illegible]“[illegible]”[illegible]110[illegible]

[5] [illegible]PLC-Power Line Communication or Power Line Carrier[illegible]

[6] [illegible]smart house[illegible]smart building[illegible]smart home[illegible]

[7] [illegible]

[8] [illegible]·[illegible]1990[illegible]

[9] [illegible]PARC[illegible]Palo Alto Research Center, Inc.[illegible]Xerox Palo Alto Research Center[illegible]1970[illegible]Smalltalk[illegible]Interpress[illegible]PostScript[illegible]2002[illegible]1[illegible]4[illegible]

[10] [illegible]GUI-Graphical User Interface[illegible]GUI[illegible]GUI[illegible]GUI“[illegible]”[illegible]

[11] [illegible]·[illegible]Mark Weiser, 1952.07.23[illegible]1999.04.27[illegible]1999[illegible]

[12] [illegible]Microcosm

[13] [illegible]Ubiquitous Computing[illegible]Pervasive Computing[illegible]·[illegible]1980[illegible]1990[illegible]1990[illegible]“[illegible]”[illegible]Cloud Computing[illegible]

[14] [illegible]The Prisoner[illegible]1967[illegible]2009[illegible]11[illegible]AMC[illegible]

[15] [illegible]Bellcore-Bell Communication Research[illegible]1984[illegible]AT&T[illegible]

[16] [illegible]·[illegible]Hardin Tibbs[illegible]

[17] [illegible]·[illegible]Robert Frosch, 1928.05.22[illegible]1977[illegible]1981[illegible]NASA[illegible]

[18] [illegible]

[19] [illegible]

[20] [illegible]Just-In-Time System[illegible]JIT System[illegible]Pull System[illegible]Push System[illegible]

[21] [illegible]Omega Point[illegible]

11

[illegible]

OUT OF CONTROL

11.1 [illegible]

[illegible]·[illegible]·[illegible]John Perry Barlow[illegible]“[illegible]”[1][illegible]“[illegible]”[2][illegible]

[illegible]WELL[3][illegible]“[illegible]”[illegible]

[illegible]WELL[illegible]

[illegible]

“[illegible]”[illegible]

“[illegible]”

“[illegible]”

“[illegible]”[illegible]

[illegible][4][illegible]·[illegible][5][illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]——[illegible]”[illegible]

11.2 [illegible]

[illegible]II[illegible]

[illegible]Net[illegible]——[illegible]II[illegible]Net[illegible]

[illegible]——Net[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]1992[illegible]1993[illegible]——[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

[illegible]

- ◆ [illegible]
- ◆ [illegible]
- ◆ [illegible]
- ◆ [illegible]

[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]ATM[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]1993[illegible]——[illegible]——[illegible]X[illegible]

[illegible]10[illegible]

[illegible]“[illegible]”[illegible]

[illegible][6][illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]IBM[illegible]——[illegible]IBM[illegible]IBM[illegible]

[illegible]“800”[illegible]

11.3 [illegible]

[illegible]

[illegible]——[illegible]

[illegible]Open Vision[illegible]CEO[illegible]·[illegible]“[illegible]”Open Vision[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]

[illegible] 1 [illegible] 2 [illegible] —— [illegible] —— [illegible]

[illegible] Chiat/Day[7] [illegible] “[illegible]” [illegible]

[illegible] “[illegible]” [illegible]

[illegible] CEO [illegible] —— [illegible]

[illegible] “[illegible]” [illegible]

[illegible]·[illegible]·[illegible][8] [illegible] 1990 [illegible] 3/4 [illegible]

[illegible] Synertek[9] [illegible][10] [illegible][11] [illegible][12] [illegible] ITT [illegible]
ComputerLand [illegible]

[illegible]·[illegible]EDS[13][illegible]EDS[illegible]EDS[illegible]10[illegible]47[illegible]

[illegible]——[illegible]

[illegible]VISA[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]

[illegible]IBM[illegible]IBM[illegible]

[illegible]——[illegible]

[illegible]

[illegible]Sony[illegible]Beta VCR[illegible]

[illegible]——[illegible]

[illegible]

[illegible]UPC[illegible]

[illegible]——[illegible]

11.4 [illegible]

[illegible][14][illegible]

- [illegible]
- [illegible]
- [illegible]

[illegible]

[illegible]

[illegible]Beta[illegible]

[illegible]

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[illegible]

[illegible]·[illegible][15][illegible]·[illegible]

[illegible]——[illegible]——[illegible]

[illegible]

[illegible]63.25[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]0.000[illegible]“[illegible]”[illegible]0.001[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]

[illegible]C. K. [illegible]

[illegible]

[illegible]“[illegible]”[illegible]——[illegible]

[illegible]·[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]

[illegible]Poka-Yoke[illegible][16]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]1982[illegible]IEEE[illegible]

[illegible]IBM[illegible]IMS[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]OOP[illegible]OOP[illegible]“[illegible]”[illegible]OOP“[illegible]”[illegible]“[illegible]”[illegible]OOP[illegible]“[illegible]”[illegible]

OOP[illegible]“[illegible]”[illegible]Lego[illegible]OOP[illegible]

[illegible]

[illegible]IBM[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]

[illegible]SmallTalk[illegible]
HyperCard[illegible]“[illegible]”[illegible]direct manipulation[illegible]“[illegible]”

[illegible]“[illegible]……[illegible]”

[illegible]

[illegible]“[illegible]”[illegible]——[illegible]

[illegible]·[illegible][17][illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]

[illegible][18][illegible]“[illegible]”[illegible]“[illegible]”[illegible]

11.5 [illegible]

[illegible]——[illegible]

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◆ [illegible]——[illegible]“[illegible]500[illegible]”[illegible]

◆ [illegible]——[illegible]“[illegible]”[illegible]700[illegible][19][illegible]

◆ [illegible]——[illegible]

◆ [illegible]——[illegible]……[illegible]

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◆ [illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

◆ [illegible]——[illegible]

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◆ [illegible]——[illegible]

◆ [illegible]——[illegible]10[illegible]

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[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]

[1] [illegible]The Grateful Dead, 1964[illegible]1995[illegible]In the Dark[illegible]Workingman's Dead[illegible]American Beauty[illegible]

[illegible]

[2] “[illegible]”[illegible]Deadhead[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[3] The WELL[illegible]Whole Earth 'Lectronic Link[illegible]1985[illegible]

[4] [illegible]cyberspace[illegible]matrix[illegible]jiack-in[illegible]

[5] [illegible]·[illegible]William Gibson, 1948.03.17[illegible]Cyberpunk[illegible]Neuromancer[illegible]1984[illegible]“[illegible]”[illegible]

[6] [illegible]·[illegible]Levi Strauss[illegible]Levi's[illegible]1979[illegible]

[7] Chiat/Day[illegible]1968[illegible]Jay Chiat[illegible]Guy Day[illegible]Chiat/Day[illegible]Chiat/Day[illegible]1994[illegible]Chiat/Day[illegible]1995[illegible]Chiat/Day[illegible]Omnicom[illegible]Omnicom1993[illegible]TBWA[illegible]TBWA/Chiat/Day[illegible]

[8] [illegible]·[illegible]·[illegible]James Brian Quinn[illegible]

[9] Synertek[illegible]1973[illegible]Honeywell[illegible]1985[illegible]

[10] [illegible]Qume[illegible]

[11] [illegible]Regis Mckenna[illegible]1970[illegible]Intel[illegible]

[12] [illegible]Frogdesign[illegible]1969[illegible]

[13] EDS[illegible]Electronic Data System[illegible]2008[illegible]

[14] [illegible]self-being[illegible]self-making[illegible]

[15] [illegible]·[illegible]David Parnas[illegible]

[16] Poka-Yoke[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[17] [illegible]·[illegible]Herbert Simon, 1916.06[illegible]2001.02[illegible]bounded rationality[illegible]satisficing[illegible]architecture of complexity[illegible]1975[illegible]1978[illegible]1986[illegible]1993[illegible]

[18] [illegible]semiliving[illegible]KK[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[19] 700[illegible]700[illegible]

[20] [illegible]Teilhard de Chardin[illegible]1923[illegible]1946[illegible]“[illegible]”[illegible]

12

[illegible]

OUT OF CONTROL

12.1 [illegible]

[illegible]·[illegible]9.95[illegible]DAT[illegible]——[illegible]——[illegible]DAT[illegible][1][illegible]DAT[illegible]

[illegible]DAT[illegible]·[illegible]

[illegible]DAT[illegible]——[illegible]·[illegible]CD[illegible]“[illegible]”[illegible]

“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]Adobe Photoshop[2][illegible]”

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[illegible]——[illegible]

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[illegible]1992[illegible]“[illegible]”[illegible]

1992[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]·[illegible]PGP[illegible][4][illegible][5][illegible]

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[illegible]·[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]a[illegible]x[illegible]a[illegible]y[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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[illegible]·[illegible]“[illegible]——[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]——[illegible]

12.2 [illegible]

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[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]——[illegible]

[illegible]PGP[illegible]Pretty Good Privacy[illegible]PGP[illegible]“[illegible]”[illegible]

PGP[illegible]RIPEM[illegible]PGP[illegible]RSA[illegible]RSA[illegible]RIPEM[illegible]RSA[illegible]PGP[illegible]·[illegible]PGP[illegible]RSA[illegible]

RSA[illegible]RSA[illegible]PGP[illegible]RSA[illegible]PGP[illegible]

[illegible]PGP[illegible]RSA[illegible]
PGP[illegible]

[illegible]PGP[illegible]RSA[illegible]RSA[illegible]PGP[illegible]RSA[illegible]PGP[illegible]RIPEM[illegible]PGP[illegible]——[illegible]PGP[illegible]RSA[illegible]

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12.3

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[illegible]“[illegible]”——[illegible]——[illegible]“[illegible]”[illegible]——[illegible]

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[illegible]“[illegible]”[illegible]·[illegible]

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[illegible]·[illegible]NeXT[illegible][6][illegible]

[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]·[illegible]“[illegible]‘[illegible]’[illegible]”

“[illegible]”[illegible]“[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]ASCAP[illegible]BMI[illegible]

[illegible]JEIDA[illegible]“[illegible]“[illegible]”[illegible]”[illegible]‘[illegible]’[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]Wave Inc. [illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]——[illegible][7][illegible]·[illegible]

12.4 [illegible]

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[illegible]ATM[illegible]ATM[illegible]——[illegible]——[illegible]

[illegible]Visa[illegible]1975[illegible]Visa[illegible]ATM[illegible]

[illegible]National Trust Me[illegible]ATM[illegible]National Trust Me[illegible]

[illegible]Visa[illegible]

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[illegible]Trust Me[illegible]Trust Me[illegible]ATM[illegible]

[illegible]“[illegible]”[illegible]

[illegible]——[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]

[illegible]……[illegible]CPU[illegible]Cylink[8][illegible]

[illegible]——[illegible]NTT[illegible]40[illegible]“[illegible]”[illegible]——[illegible]

[illegible]1[illegible]2[illegible]——[illegible]

[illegible]·[illegible]

[illegible]——[illegible]——[illegible]

1978[illegible]“[illegible]……[illegible]……[illegible]1984[illegible]1985[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]1[illegible]

[illegible]“[illegible]‘[illegible]’[illegible]”

[illegible]

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[illegible]——[illegible]RSA[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”——[illegible]ATM[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]1[illegible]”[illegible]“[illegible]”

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[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]99.99[illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]……[illegible]

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12.5 [illegible]

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◆ [illegible] ATM [illegible]“[illegible]”[illegible]·[illegible][9][illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[10]——[illegible]

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◆ [illegible] 2140 [illegible]

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[illegible]“[illegible]”[illegible]

12.6 [illegible]

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[illegible]

[1] [illegible]K-Mart[illegible]

[2] Adobe Photoshop[illegible]

[3] [illegible]Peer-to-Peer[illegible]P2P[illegible]“[illegible]”[illegible]point-to-point[illegible]peer-to-peer[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[4] PGP[illegible]PGP[illegible]Pretty Good Privacy[illegible]“[illegible]”[illegible]·[illegible]Philip R. Zimmermann[illegible]1991[illegible]

[5] [illegible]——[illegible]——[illegible]

[6] NeXT[illegible]1985[illegible]NeXT[illegible]

[7] [illegible]National Semiconductor[illegible]

[8] Cylink[illegible]2003[illegible]SafeNet[illegible]

[9] [illegible]·[illegible]Alvin Toffler[illegible]

[10] [illegible]float[illegible]

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[illegible] [illegible]

OUT OF CONTROL

13.1 [illegible]

[illegible]2[illegible]

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[illegible]“[illegible]”——[illegible]“[illegible]”——[illegible]——[illegible]

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[illegible]“[illegible]93[illegible]”

[illegible]·[illegible]“[illegible]”[illegible]

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“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”

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（2）[illegible]——[illegible]

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13.3 “[illegible]”[illegible]

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[illegible]“[illegible]”[illegible]

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[illegible]“[illegible]”[illegible][6][illegible]“[illegible]”

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[illegible][7][illegible]……[illegible]

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[illegible]“[illegible]”[illegible]simulacrum[illegible]1382[illegible]“[illegible]”[illegible]“[illegible]”[illegible]idol[illegible]

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13.4 [illegible]

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[illegible]“[illegible]”[illegible]SIMNET[illegible]“[illegible]73[illegible]”[illegible][12][illegible]·[illegible]SIMNET“[illegible]”[illegible]SIMNET[illegible][13][illegible]M1[illegible]SIMNET[illegible]——[illegible]

[illegible]M1[illegible]SIMNET[illegible]M1[illegible]M1[illegible]

[illegible]M1[illegible]SIMNET[illegible]M1[illegible]——[illegible]——[illegible]

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13.6 [illegible]

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1990[illegible]T[illegible]

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[illegible]VS-X[23][illegible]

[illegible]ADST[24][illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

13.7 [illegible]

[illegible]·[illegible]·[illegible]“[illegible]”

[illegible][25][illegible]“[illegible]”（DSI）[26][illegible]

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13.8 [illegible]

[illegible]Lotsu[illegible][27][illegible]

[illegible][28][illegible][29][illegible]·[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

1978[illegible]·[illegible]·[illegible]“[illegible]”[illegible]MUD[illegible][30][illegible]

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13.9

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[illegible]——[illegible]SIMNET[illegible]

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[1] [illegible]Electronic Arts, Inc.[illegible]

[2] [illegible]$E=mc^2$[illegible]

[3] [illegible]Silicon Graphics[illegible]2006[illegible]3[illegible]

[4] [illegible]·[illegible]Jaron Lanier, 1960.03[illegible]

[5] [illegible]·[illegible]Umberto Eco[illegible]1932[illegible]

[6] [illegible]hyperreality[illegible]

[7] [illegible]Jorge Luis Borges, 1899[illegible]1986[illegible]

[8] [illegible]Artificial Life, 1991

[9] [illegible]I Love Lucy[illegible]

[10] [illegible]73[illegible]Battle of 73 Easting[illegible]1991[illegible]73[illegible]

[11] [illegible]Shamal Sandstorm[illegible]

[12] [illegible]National Defense

[13] [illegible]Fort Knox[illegible]·[illegible]

[14] [illegible]IEEE[illegible]IEEE Spectrum

[15] [illegible]Institute for Simulation and Training

[16] [illegible]·[illegible]·[illegible]Orson Scott Card[illegible]1986[illegible]1987[illegible]

[17] [illegible]Ender's Game

[18] [illegible]Telepresent

[19] [illegible]Merchant Marine Academy

[20] Radio Shack[illegible]1921[illegible]

[21] [illegible]DARPA[illegible]Defense Advanced Research Projects Agency[illegible]

[22] [illegible]Northrop[illegible]

[23] [illegible]

[24] ADST[illegible]Advanced Distributed Simulation Technology

[25] [illegible]

[26] [illegible]DSI[illegible]Distributed Simulation Internet

[27] [illegible]Multiuser Fantasy Game

[28] [illegible]Star Trek[illegible]1960[illegible]TV Guide[illegible]“[illegible]25[illegible]”[illegible]Star Trek[illegible]2009[illegible]

[29] [illegible]The Hobbit[illegible]1937[illegible]

[30] MUD[illegible]Multi-User Dungeon[illegible]Multi-User Dimension[illegible]Multi-User Dialogue[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]1995[illegible]“[illegible]”[illegible]

[31] [illegible]Zork[illegible]1977[illegible]1979[illegible]“Zork”[illegible]“[illegible]”[illegible]

[32] [illegible]College of Amherst[illegible]1821[illegible]

[33] [illegible]Scandinavia[illegible]

[34] [illegible]·[illegible]Stanislaw Lem, 1921.09.12[illegible]2006.03.27[illegible]1961[illegible]Solaris[illegible]

[35] [illegible]·[illegible]·[illegible]11[illegible]

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OUT OF CONTROL

14.1 “[illegible]”[illegible]

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[illegible]“[illegible][1][illegible]”

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14.2 [illegible]

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[illegible]·[illegible]CM5[illegible]“[illegible]”[illegible][6][illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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14.3 [illegible]

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[illegible]·[illegible]“[illegible]”[illegible]

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14.4

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[illegible]“[illegible]5”[illegible]·[illegible]“[illegible]”

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[illegible]Adobe Photoshop[illegible]·[illegible]“[illegible]”[illegible]

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14.7 [illegible]

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【2】 ··········“····”（“··”·······universe····“··”）
【3】 ···（Topology）·····························
【4】 Hadal·······“·······6000········”。
【5】 ····（Connection Machine）······CM-1、CM-2、CM-5···I/O·······················CM-1··························16384··············4096······12·························CM-5···································
【6】 “····”（···Thinking Machines）·····1982···1994············Sun Microsystems····
【7】 ······（library of possible forms）······························“·····”····
【8】 ···（traverse）···
【9】 BASIC····“Beginner's All-purpose Symbolic Instruction Code”·····“·······················”·······················BASIC·······································
【10】 ·······：The Blind Watchmaker
【11】 ···（·····Jackson Pollock, 1912.01.28－1956.08.11）·················
【12】 ·····（Reverse Engineering）·······························
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【14】 ···
【15】 ··（·····Denis Diderot, 1713.10.05－1784.07.31）···
【16】 ·······：The Recursive Universe

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15.1 [illegible]·[illegible]

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[illegible]·[illegible]——[illegible][8]——[illegible]·[illegible]1927[illegible]·[illegible]·[illegible]——[illegible]1946[illegible]·[illegible]

1949[illegible]·[illegible]“[illegible]”[9][illegible]1950[illegible]IBM“[illegible]”[illegible]IBM 701[illegible]

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1953[illegible]R. A. [illegible][11][illegible]1929[illegible][12][illegible]——[illegible]——[illegible]“[illegible]

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15.7 [illegible]

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[illegible]300[illegible]

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[illegible]

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15.8 [illegible]

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1:1[illegible]

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15.9 [illegible]

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[illegible]“[illegible]”[illegible]

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“[illegible]”[illegible]

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[1] [illegible]·[illegible]Tom Ray[illegible]Thomas S. Ray[illegible]“Tierra”[illegible]“[illegible]”[illegible]

[2] [illegible]·[illegible]Edward Osborne Wilson, 1929.06.10[illegible] [illegible]1975[illegible]

[illegible]Sociobiology: The New Synthesis[illegible]"[illegible]"[illegible]
[illegible]

[3] [illegible]Genetic Algorithms[illegible]GA[illegible]·[illegible]

[4] [illegible]·[illegible]Lawrence Fogel, 1928.03.02[illegible]2007.02.18[illegible]

[5] [illegible]·[illegible]Hans Bremermann, 1926[illegible]1996[illegible]

[6] [illegible]Adaptation in Natural and Artificial Systems

[7] [illegible]ENIAC-Electronic Numerical Integrator and Computer[illegible]1946[illegible]2[illegible]15[illegible]Atanasoff-Berry Computer[illegible]ABC[illegible]

[8] [illegible]EDVAC-Electronic Discrete Variable Automatic Computer[illegible]·[illegible]·[illegible]·[illegible]

[9] [illegible]Whirlwind[illegible]

[10] [illegible]·[illegible]Alan Newall, 1927.03.19[illegible]1992.07.19[illegible]1975[illegible]·[illegible]

[11] R. A. [illegible]Sr. Ronald Aylmer Fisher, 1890.02.17[illegible]1962.07.29[illegible]"[illegible]"[illegible]"[illegible]"[illegible]

[12] [illegible]Genetical Theory of Natural Selection

[13] [illegible]A Universal Computer Capable of Executing an Arbitrary Number of Sub-Programs Simultaneously

[14] [illegible]·[illegible]Steven Levy, 1951[illegible]

[15] [illegible]hot spot[illegible]

[16] [illegible]complementary shape[illegible]

[17] [illegible]·[illegible]Andrew Ellington

[18] [illegible]RNA[illegible]RNA[illegible]

[19] [illegible]directed molecular evolution[illegible]

[20] [illegible]Gilead[illegible]1987[illegible]2009[illegible]70[illegible]2009[illegible]50[illegible]

[21] Ixsys[illegible]1989[illegible]"[illegible]"[illegible]Applied Molecular Evolution[illegible]AME[illegible]

[22] Nexagen[illegible]Jen Fe Next[illegible]

[23] Osiris[illegible]

[24] Selectide[illegible]1990[illegible]

[25] [illegible]Genentech[illegible]1976[illegible]

[26] [illegible]·[illegible]Manfred Eigen, 1927.05.09[illegible]·[illegible]

[27] [illegible]selection pressure[illegible]

[28] [illegible]Bellcore–Bell Communication Research[illegible]1984[illegible]1982[illegible]1996[illegible]SAIC[illegible]Telcordia[illegible]

[29] [illegible]·[illegible]Michael Littman[illegible]

[30] [illegible]Inheritance of Acquired Traits[illegible]“[illegible]”[illegible]User and Disuse[illegible]

[31] [illegible]·[illegible]Peter J. Denning, 1942[illegible] [illegible]Working-Set Model[illegible]

[32] [illegible]Highly Parallel Computation

[33] [illegible]·[illegible]John Koza[illegible]

[34] [illegible]·[illegible]Ralph Merkle[illegible]1979[illegible]2003[illegible]2006[illegible]1998[illegible]

16

[illegible]

OUT OF CONTROL

16.1 [illegible]

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[illegible]“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

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[illegible]1993[illegible]“[illegible]”[illegible]

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16.2 [illegible]

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[illegible]·[illegible]——[illegible]——[illegible]“[illegible]‘[illegible]’”[illegible]

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[illegible][17][illegible]“[illegible]”[illegible]

[illegible][18][illegible]1994[illegible]·[illegible][19][illegible]

[illegible][20][illegible]

[illegible]——[illegible]“[illegible]”[illegible]“[illegible]——[illegible]”[illegible]O[illegible]“[illegible]”

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[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”

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[illegible] 5 [illegible]

[illegible] —— [illegible]

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16.3 [illegible]

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16.4 [illegible]

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[illegible]“[illegible]”[illegible]1951[illegible][36][illegible]

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16.5 [illegible]

[illegible]

[illegible]·[illegible]“[illegible]”[37][illegible]·[illegible]——[illegible]

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[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

16.6 [illegible]

2001[illegible]2G[illegible]

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1997[illegible]——[illegible]

[illegible]“[illegible]”[illegible]

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[illegible]2007[illegible]——[illegible]——[illegible]

[illegible]

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[illegible][41][illegible]·[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

“[illegible]”[illegible]“[illegible]”[illegible]

16.7 [illegible]

[illegible]“[illegible]”[42][illegible]747[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]A320[illegible]1988[illegible]“[illegible]”[illegible]1989[illegible]747[illegible]——[illegible]——[illegible]A320[illegible]

[illegible]“[illegible]”[illegible]

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[illegible]·[illegible][43][illegible]——[illegible]——[illegible]“[illegible]”[illegible]

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[1] □□□□□□□□The Flintstones□□□□□□□□□□□□□□□□□□□□1994□□□□

[2] □□□□□□□Industrial Light and Magic□□□□□□□□□□□□□□□□□·□□□□1975□5□□□□□□□□□□□□□□

[3] □□·□□□Mark A. Z. Dippé□1958□ □□1991□□□□□□□□□□□□□□□□□□□□□□□□

[4] □□

[5] □□□·□□□Michael Kass□□□□□□□□□□□□□□□□□□□□□·□□□□□□□·□□

[6] □□·□□□Gavin Miller□□Adobe□□□□□□□

[7] □□□□□□□□CAD-Computer Assisted Design

[8] □□□□□Automatic Fabrication□□□□□□□□□□□□□□□□□□□□□□□□□Rapid Prototyping□□

[9] □□·□□□John Walker, 1950□ □□□□□□□□□AutoCAD□□□□□□□□□□□□Autodesk□□□AutoCAD□□□□□□□□□□·□□□□Michael Riddle□□□□□

[10] □□□□□□□Przemyslaw Prusinkiewicz□□□□□□□□□□□

[11] □□□□□·□□□□□Aristid Lindenmeyer, 1925.11.17□1989.10.30□□□□□□□□□□1968□□□□□□□□□□□□□L-□□□L-□□□□□□□□□□□□□□□□

[12] □□□□□□Brøderbund software□□1980□□□□□□□□□□□□□□□□□□□□□□□□□□□□□Brøderbund□□□□□□□□□□□□□□□□□□□□□band of brothers□□□□□□□□□□1998□□□□□□□The Learning Company□□□□

[13] □□□□□□The Great Mouse Detective□□□□□□□□□□□□□□□□□□□□□□□□□□□□1986□□□□

[14] □□□□□□□□□□□□□□The Rescuers Down Under□□□□□□□□1990□□□□

[15] □□□□□□□Orville the Albatross□□□□□□□□□□□□The Rescuers□□Wilbur□□

[16] □□□□□□□The little Mermaid□□□□□□□□1989□□□□

[17] □□□□□□□□Beauty and the Beast□□□□□□□□1991□□□□

[18] □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□Toy Story□□□□1995□□□□□□

[19] □□·□□□□John Lasseter□□

[20] □□□□□□Pixar□□□□□□□□□□□□□□□□□□□□□□1986□□□□·□□□□□□□□□□□□□□□□□□□□□□□□□□1991□□□□□□□□□□□□□□□2006□□□□□□□□□□□□□□□□

[21] □□□·□□□□□Ralph Guggenheim□□□1986□□□□□□□1997□□□

[22] [illegible]Tin Toy[illegible]1988[illegible]

[23] [illegible]·[illegible]·[illegible]Brad de Graf[illegible]2001[illegible]“[illegible]”[illegible]1982[illegible]

[24] [illegible]Liquid TV[illegible]MTV-Music Televisions[illegible]

[25] [illegible]Silicon Graphics Inc.[illegible]SGI[illegible]1981[illegible]11[illegible]3D[illegible]2006[illegible]3[illegible]8[illegible]

[26] [illegible]·[illegible]Peter Gabriel, 1950.02.13[illegible]

[27] [illegible]Kermit the Frog[illegible]·[illegible]Jim Henson[illegible]1955[illegible]Sesame Street[illegible]“[illegible]”[illegible]

[28] [illegible]·[illegible]David Zeltzer[illegible]

[29] [illegible]animat[illegible]

[30] [illegible]Road Runner[illegible]Wile E. Coyote[illegible]

[31] [illegible]·[illegible]Steve Strassman[illegible]·[illegible]

[32] [illegible]·[illegible]Michael McKenna[illegible]

[33] [illegible]·[illegible]Konrad Lorenz, 1903[illegible]1989[illegible]1973[illegible]

[34] [illegible]·[illegible]·[illegible]Karl von Frisch, 1886.11.20[illegible]1982.06.12[illegible]

[35] [illegible]·[illegible]Niko Tinbergen, 1907[illegible]1988[illegible]

[36] [illegible]The Study of Insect

[37] [illegible]Oz[illegible]——[illegible]

[38] [illegible]·[illegible]Pattie Maes[illegible]1994[illegible]

[39] [illegible]·[illegible]Sandy Pentland[illegible]

[40] [illegible]Who Framed Roger Rabbit[illegible]1988[illegible]1989[illegible]

[41] [illegible]Steamboat Willie[illegible]——1928[illegible]11[illegible]18[illegible]——[illegible]

[42] [illegible]co-control

[43] [illegible]·[illegible]Pete Litwinowicz[illegible]

[44] [illegible]·[illegible]·[illegible]James Francis Cameron, 1954.08.16[illegible]·[illegible]

17

[illegible]

OUT OF CONTROL

17.1 [illegible]

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[illegible]

[illegible]·[illegible]

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17.2 [illegible]

[illegible]1990[illegible]·[illegible]CM2[illegible]

[illegible]LISP[illegible][1][illegible]“[illegible]”——[illegible]

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[illegible]

[illegible]LISP[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

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(cos (round (atan (log (invert y) (+ (bump (+ (round x y)
y) #(0.46 0.82 0.65) 0.02 #(0.1 0.06 0.1) #(0.99 0.06 0.41)
1.47 8.7 3.7) (color-grad (round (+ y y) (log (invert x) (+
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(invert y) (round (+ y x) (bump (warped-ifs (round y y) y
0.08 0.06 7.4 1.65 6.1 0.54 3.1 0.26 0.73 15.8 5.7 8.9 0.49
7.2 15.6 0.98) #(0.46 0.82 0.65) 0.02 #(0.1 0.06 0.1) #
(0.99 0.06 0.41) 0.83 8.7 2.6))))) 3.1 6.8 #(0.95 0.7 0.59)
0.57))) #(0.17 0.08 0.75) 0.37) (vector y 0.09 (cos (round y
y)))))
```

[illegible]“[illegible]——[illegible]”

[illegible]

17.3 [illegible]

[illegible]·[illegible]·[illegible]

[illegible]“[illegible]”[illegible]

[illegible]——[illegible][3][illegible]“[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]1[illegible]2[illegible]——[illegible]——[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]LISP[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

tic-tac-toe[4]

·[5]

```
(SIN (IFLTE (IFLTE (+ Y Y) (+ X Y) (- X Y) (+ Y Y)) (* X X)
(SIN (IFLTE (% Y Y) (% (SIN (SIN (% Y 0.30400002))) X) (% Y
0.30400002) (IFLTE (IFLTE (% (SIN (% (% Y (+ X Y))
0.30400002)) (+ X Y)) (% X 0.10399997) (- X Y) (* (+
-0.12499994 -0.15999997) (- X Y))) 0.30400002 (SIN (SIN
(IFLTE (% (SIN (% (% Y 0.30400002) 0.30400002)) (+ X Y))
(% (SIN Y) Y) (SIN (SIN (SIN (% (SIN X) (+ -0.12499994
-0.15999997))))) (% (+ (+ X Y) (+ Y Y)) 0.30400002)))) (+
(+ X Y) (+ Y Y))))) (SIN (IFLTE (IFLTE Y (+ X Y) (- X Y) (+ Y Y))
(* X X) (SIN (IFLTE (% Y Y) (% (SIN (SIN (% Y 0.30400002)))
X) (% Y 0.30400002) (SIN (SIN (IFLTE (IFLTE (SIN (% (SIN X)
(+ -0.12499994 -0.15999997))) (% X -0.10399997) (- X Y)
(+ X Y)) (SIN (% (SIN X) (+ -0.12499994 -0.15999997))) (SIN
(SIN (% (SIN X) (+ -0.12499994 -0.15999997)))) (+ (+ X Y)
(+ Y Y))))))) (% Y 0.30400002))))).
```

·

[illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]·[illegible]

17.4 [illegible]

[illegible]f[illegible]ma[illegible][6][illegible]f[illegible]ma[illegible]

[illegible]——[illegible]·[illegible]

[illegible][7]1992[illegible]·[illegible][8][illegible]“[illegible]”[illegible]

[illegible]·[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”

[illegible]

[illegible]

[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]

[illegible]

“[illegible]”[illegible]·[illegible]

[illegible]·[illegible]“[illegible]”

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]——[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]

[illegible]”

[illegible]·[illegible]——[illegible]

17.5 [illegible]

[illegible]

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- [illegible]
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[illegible]

[illegible]“[illegible]”[illegible]·[illegible]——[illegible]——[illegible]

[illegible]DNA[illegible]——[illegible]DNA[illegible]DNA[illegible]

[illegible]DNA[illegible]DNA[illegible]

[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible][9][illegible]——[illegible]·[illegible]“[illegible]”

[illegible]“[illegible]”——[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]

[illegible]”

17.6 [illegible]

[illegible]

[illegible]

[illegible][10][illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]DNA[illegible][11][illegible]ll[illegible][12][illegible]——[illegible]“[illegible]”[illegible]

[illegible]·[illegible]·[illegible]·[illegible]ll[illegible]·[illegible]Q[illegible]

[illegible]1987[illegible]“[illegible]”[13]——[illegible]

17.7 [illegible]

[illegible]——[illegible]“[illegible]”[illegible]——[illegible]

[illegible]“[illegible]”

17.8 [illegible]

[illegible]

[illegible]

[illegible]

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[illegible]“[illegible]”[illegible]——[illegible]——[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]·[illegible]“[illegible]·[illegible]”[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

“[illegible]”[illegible]·[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”[illegible][14][illegible]·[illegible]“[illegible]——[illegible]——[illegible]”

[illegible]——[illegible]——[illegible]

“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]·[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]

[illegible]·[illegible]——[illegible]·[illegible]“[illegible]”

[illegible]

[1] LISP[illegible]LISP[illegible]List Processing[illegible]list[illegible]LISP[illegible]LISP[illegible]

[2] [illegible]Soup[illegible]alphabet soup[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[3] [illegible]Genetic Programming

[4] tic-tac-toe[illegible]

[5] [illegible]·[illegible]Rube Goldberg[illegible]

[6] f[illegible]ma[illegible]f[illegible]m[illegible]a[illegible]

[7] [illegible]Daedalus[illegible]

[8] [illegible]boomerang effect[illegible]

[9] [illegible]ribozyme[illegible]RNA[illegible]1989[illegible]

[10] [illegible]Los Alamos National Laboratory[illegible]

[11] [illegible]The Evolution of Culture

[12] [illegible]cellular automata[illegible]

[13] “[illegible]”（Interdisciplinary Workshop on the Synthesis and Simulation of Living Systems）[illegible]“[illegible]”（Artificial Life）[illegible]

[14] [illegible]Artificial Life: The Coming Evolution

18

OUT OF CONTROL

18.1

[illegible]——[illegible]

[illegible]·[illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

[illegible][1][illegible]——[illegible]

[illegible]——[illegible]

18.2 [illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]——[illegible]

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[illegible]——[illegible]

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[illegible]2[illegible]

[illegible]“[illegible]”[illegible]——[illegible]

[illegible][2][illegible]“[illegible]”[3][illegible]·[illegible]“[illegible]”[4][illegible]——[illegible]“[illegible]”[illegible][5][illegible]1896[illegible]“[illegible]”。

[illegible]3[illegible]——[illegible]

[illegible]——[illegible]“[illegible]”[illegible]——[illegible]——[illegible]

[illegible]

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[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]·[illegible]

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[illegible]·[illegible]

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- ◆ [illegible]
- ◆ [illegible]

[illegible]

18.3 [illegible]

[illegible]——[illegible]·[illegible]·[illegible]1990[illegible]·[illegible]·[illegible]1987[illegible]"[illegible]"[illegible]1991[illegible]12[illegible][6][illegible]

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[illegible]——[illegible]——[illegible]"[illegible]"[illegible]

[illegible]·[illegible]

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[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”——[illegible]

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[illegible]——[illegible]——[illegible]“[illegible]”——[illegible]

[illegible]

[illegible]

[illegible]——[illegible]·[illegible]——[illegible]“[illegible]”[illegible]

18.4 [illegible]

[illegible]

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- [illegible]

[illegible]

[illegible]·[illegible][9][illegible]·[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]

18.5 [illegible]

[illegible]

[illegible]

[illegible]·[illegible]“[illegible]”

[illegible]·[illegible][10][illegible]“[illegible]——[illegible]——[illegible]”

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]

[1] [illegible]Genentech[illegible]

[2] [illegible]C. H. Waddington, 1905[illegible]1975[illegible]

[3] [illegible]Genetic Assimilation

[4] [illegible]Somatic Adaptation

[5] [illegible]J. M. Baldwin, 1861[illegible]1934[illegible]

[6] [illegible]First European Conference on Artificial Life

[7] [illegible]·[illegible]·[illegible]Steven Jay Gould, 1941[illegible]2002[illegible]

[8] [illegible]Cro-Magnon[illegible]KK[illegible]

[9] [illegible]·[illegible]Walter Fontana[illegible]2004[illegible]

[10] [illegible]Evolution as a Religion

19

OUT OF CONTROL

19.1 [illegible]

“[illegible]”[illegible]·[illegible]

[illegible]“[illegible]”[illegible]1965[illegible]1974[illegible]·[illegible]——[illegible]

[illegible]

[illegible]

[illegible]“[illegible]”[illegible]·[illegible][1][illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]1859[illegible]——“[illegible]”[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“DNA”[illegible]——[illegible]——[illegible]

[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]——[illegible]

[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]“[illegible]——[illegible]‘[illegible]’——[illegible]‘[illegible]’[illegible]”

[illegible]

[illegible]·[illegible]——[illegible]——[illegible]

[illegible]

19.2 [illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]·[illegible]“[illegible]……[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]

19.3 [illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

[illegible]

[illegible]DNA[illegible]——[illegible]DNA[illegible]

[illegible]

[illegible]——[illegible]

[illegible]——[illegible]

19.4 [illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”——[illegible]

[illegible]·[illegible]“[illegible]”[illegible]

[illegible]

[illegible]·[illegible]·[illegible]“genetics”——[illegible]——[illegible]——[illegible]——[illegible]

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[illegible]——[illegible]1926[illegible][3][illegible]

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[illegible]——[illegible]·[illegible]“[illegible]”[illegible]

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[illegible]“[illegible]”[illegible]——[illegible]·[illegible]“[illegible]”

[illegible]

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[illegible]·[illegible]

[illegible]“[illegible]”[illegible]

[illegible]

19.5 [illegible]

[illegible]

[illegible]DNA[illegible]——[illegible]

[illegible]——[illegible]

[illegible]

[illegible]

[illegible]——[illegible]

[illegible]——[illegible]

[illegible]——[illegible][6]——[illegible]

[illegible]·[illegible]“[illegible][7][illegible]”

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]——[illegible]

[illegible]

19.6 [illegible]

[illegible] DNA[8] [illegible] [9] [illegible] —— [illegible] —— [illegible]

[illegible] DNA [illegible] DNA [illegible] DNA [illegible] DNA [illegible] DNA [illegible] · [illegible] “[illegible]”[illegible]

[illegible] DNA [illegible] · [illegible] “[illegible]” [illegible]

[illegible] · [illegible] 1940 [illegible] [10] [illegible] · [illegible] · [illegible]

[illegible]

[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]……[illegible]”

19.7 [illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”[illegible]·[illegible]·[illegible]

[illegible]……[illegible]

[illegible]……

[illegible]“[illegible]”[illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]1[illegible]2[illegible]3[illegible]

[illegible]

[illegible]——[illegible]——[illegible]——[illegible]——[illegible]

“[illegible]”[illegible]

[illegible][11][illegible]

[illegible]saltare[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

19.8 DNA[illegible]

[illegible]DNA[illegible]

[illegible]A[illegible]B[illegible]B[illegible]C[illegible]C[illegible]A[illegible]——[illegible]

[illegible]“[illegible]”[illegible]·[illegible]“[illegible]50[illegible]”[illegible]

[illegible][12][illegible]

[illegible]——[illegible]——[illegible]

[illegible][13][illegible]“[illegible]5[illegible]99.999[illegible]”[illegible]

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[illegible]——[illegible]

[illegible]“[illegible]”[illegible]99.999[illegible]——[illegible]“[illegible]”[illegible]

19.9 [illegible]

[illegible]“[illegible]……”[illegible]

[illegible][14][illegible][15][illegible]

[illegible]

[illegible]——[illegible]——[illegible]

[illegible]——[illegible]——[illegible]——[illegible]

[illegible]

[illegible]——[illegible]——[illegible]“[illegible]”[illegible]

[illegible]

[illegible]——[illegible]——[illegible]——[illegible]

[illegible]

19.10 [illegible]

[illegible]

[illegible]——[illegible]

[illegible]

[illegible]1[illegible]2[illegible]3[illegible]6[illegible]7[illegible]·[illegible]“[illegible]”

[illegible]$E=mc^2$[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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- ◆ [illegible]——[illegible]
- ◆ [illegible]——[illegible]
- ◆ [illegible]——[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”

[illegible]

[1] [illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]·[illegible]

[2] [illegible]DNA[illegible]DNA[illegible]

[3] [illegible]J. C. Smuts, 1870[illegible]1950[illegible]1926[illegible]

[4] [illegible]Krebs Cycle[illegible]Hans Adolf Krebs[illegible]1937[illegible]ATP[illegible]

[5] [illegible]Homeobox[illegible]·[illegible]

[6] [illegible]Etienne Saint Hilaire, 1772[illegible]1844[illegible]Isidore Geoffroy Saint Hilaire, 1805[illegible]1861[illegible]“[illegible]”[illegible]ethology[illegible]1832[illegible]1837[illegible]Teratology[illegible]

[7] [illegible]Negative Selection[illegible]“[illegible]”[illegible]Purifying Selection[illegible]

[8] [illegible]DNA[illegible]nonchromosomal DNA[illegible]DNA[illegible]DNA[illegible]DNA[illegible]DNA[illegible]

[9] [illegible]100[illegible]25[illegible]500[illegible]

[10] [illegible]The Material Basis of Evolution

[11] [illegible]saltationism

[12] [illegible]Basin of Attraction[illegible]

[13] [illegible]Toward a New Philosophy of Biology: Observations of an Evolutionist, Ernst Mayr, Harvard University Press, 1989.

[14] [illegible]feasible[illegible]

[15] [illegible]“[illegible]”[illegible]“[illegible]”[illegible]

20

[illegible]

OUT OF CONTROL

20.1 [illegible]

[illegible]

[illegible][1]——[illegible]——[illegible]

[illegible]·[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]50[illegible]

[illegible]50[illegible]

[illegible]·[illegible]·[illegible]1961[illegible]DNA[illegible]

[illegible]……

[illegible]

[illegible]——[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

“[illegible]”[illegible]“[illegible]”[illegible]1970[illegible]·[illegible]

20.2 [illegible]

[illegible]

[illegible] [2] [illegible]

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[illegible]——[illegible]“[illegible]”[illegible]

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[illegible]“[illegible]”[illegible]

[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

20.3 [illegible]

[illegible]

[illegible]——[illegible]

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[illegible]“[illegible]”[illegible]200[illegible]“[illegible]”[illegible]·[illegible]“[illegible]”

[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

20.4 [illegible]

[illegible]

[illegible]

[illegible]

[illegible] 1958 [illegible] 1959 [illegible]

[illegible]

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“[illegible]”[illegible]“[illegible]——[illegible]·[illegible][4][illegible]——[illegible]”

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[illegible]749999[illegible]

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20.5 [illegible]

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[illegible]

[1] [illegible]antichaos[illegible]——[illegible]

[2] [illegible]Spin Glass[illegible]

[3] [illegible]·[illegible]Kurt Godel, 1906[illegible]1978[illegible]

[4] [illegible]·[illegible]John Wheeler, 1911[illegible]2008[illegible]“[illegible]”[illegible]

[5] [illegible]·[illegible]Mitch Waldrop[illegible]

[6] [illegible]Complexity-The Emerging Science at the Edge of Order and Chaos, 1992[illegible]

[7] [illegible]Homeorhesis[illegible]“[illegible]”[illegible]Homeostasis[illegible]

[8] [illegible]Poised System[illegible]“[illegible]”[illegible]

[9] [illegible]·[illegible]John Barrow, 1952[illegible]

[10] [illegible]·[illegible]Paul Davies, 1946[illegible]

[11] [illegible]·[illegible]Rich Bageley[illegible]

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OUT OF CONTROL

21.1 [illegible][1]

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21.2 [illegible]

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21.3 [illegible]

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- ◆ [illegible]1871[illegible]
- ◆ [illegible]1890[illegible]
- ◆ [illegible]1960[illegible]
- ◆ [illegible]1960[illegible]

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- [illegible]（1976[illegible]）
- [illegible]（1972[illegible]）
- [illegible]（1986[illegible]）
- [illegible]（1986[illegible]）

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21.4

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[1] [illegible]Ponzi Scheme[illegible]“[illegible]Pyramid Scheme[illegible]”[illegible]·[illegible]Charles Ponzi[illegible]“[illegible]”[illegible]

[2] [illegible]Ether[illegible]Aether[illegible]

[3] [illegible]Sadi Carnot, 1796[illegible]1832[illegible]1824[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”[illegible]

[4] [illegible]Vitalism[illegible]

[5] [illegible]Wonderful Life-The Burgess Shale and the Nature of History, 1990[illegible]

[6] [illegible]Burgess Shale Fossils[illegible]1909[illegible]5.15[illegible]6.5[illegible]

[7] [illegible]It's a Wonderful Life[illegible]1947[illegible]·[illegible]Jimmy Stewart[illegible]

[8] [illegible]Design for a Brain: The Origin of Adaptive Behavior, 1952[illegible]

[9] [illegible]Cope's rule[illegible]

[10] [illegible]Evolving Hierarchical Systems

[11] [illegible]The Evolution of Evolvability

[12] [illegible]Wisdom of the Genes

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[illegible]

OUT OF CONTROL

22.1 [illegible]

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22.2 [illegible]

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[illegible]1952[illegible]“[illegible]”[illegible]·[illegible]

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22.4 [illegible]

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22.5 [illegible]

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[illegible]“[illegible]——[illegible]……[illegible]”

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1989[illegible]·[illegible]“[illegible]”[illegible]

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22.6 [illegible]

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[illegible]“[illegible]”[illegible]f=ma[illegible]

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22.7 [illegible]

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22.8

22.9 [illegible]

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[illegible]——[illegible]

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“[illegible]”[illegible]“[illegible]”[illegible]——[illegible]“[illegible]”[illegible]“[illegible]”[illegible]“[illegible]”

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22.10 [illegible]

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[1] [illegible]Eudaemonic Pie

[2] [illegible]·[illegible]Theodore Modis, 1943[illegible]

[3] [illegible]Predictions

[4] 0201483408[illegible]0201483408[illegible]ISBN[illegible]

[5] [illegible]·[illegible]Nikolai D. Kondratieff, 1892[illegible]1938[illegible]

[6] [illegible]·[illegible]Arnulf Grubler[illegible]Trieste[illegible]

[7] [illegible]·[illegible]Richard J. Sweeney[illegible]·[illegible]·[illegible]

[8] [illegible]·[illegible]Blake LeBaron[illegible]

[9] [illegible]·[illegible]Dennis Meadows, 1942[illegible]

[10] [illegible]·[illegible]Dana Meadows, 1941[illegible]2001[illegible]·[illegible]“[illegible]”[illegible]

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OUT OF CONTROL

23.1 [illegible]

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[illegible]1959[illegible]1942[illegible]9[illegible]·[illegible]·[illegible]·[illegible]·[illegible]·[illegible]·[illegible]·[illegible]——[illegible]“[illegible]”[illegible]

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23.2 [illegible]

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23.3 [illegible]

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[1] [illegible]·[illegible]Thomas Kuhn, 1922[illegible]1996[illegible]“[illegible]”[illegible]

[2] [illegible]The Structure of Scientific Revolutions

[3] [illegible]

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[5] [illegible]Writing Spaces

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